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### Big five personality factors, obesity and 2-year weight gain in Australian adults

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## Abstract

The objective of this paper was to examine whether the Big-Five Personality factors were associated with obesity and 2-year weight gain in Australian adults. The sample included 5265 Australian adults aged 25–65 years. Binary logistic regression models indicated that Extraversion, Agreeableness and Neuroticism were cross-sectionally associated with obesity, with Conscientiousness inversely associated with obesity. The longitudinal analyses indicated that Extraversion predicted 2-year weight gain. The relationships between personality and obesity/weight gain were not moderated by age or sex. These results have potentially important implications for developing more effective treatment and prevention strategies for obesity.

## Keywords

adults, personality, factors, obesity, big, 2, five, year, weight, gain, australian

## Disciplines

Arts and Humanities | Life Sciences | Medicine and Health Sciences | Social and Behavioral Sciences

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**Article Title:** Big Five Personality Factors, Obesity and 2-year weight gain in Australian Adults

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## **Abstract**

The objective of this paper was to examine whether the Big-Five Personality factors were associated with obesity and 2-year weight gain in Australian adults. The sample included 5265 Australian adults aged 25–65 years. Binary logistic regression models indicated that Extraversion, Agreeableness and Neuroticism were cross-sectionally associated with obesity, with Conscientiousness inversely associated with obesity. The longitudinal analyses indicated that Extraversion predicted 2-year weight gain. The relationships between personality and obesity/weight gain were not moderated by age or sex. These results have potentially important implications for developing more effective treatment and prevention strategies for obesity.

**Keywords:** obesity, personality, Big-Five, weight gain.

## **Introduction**

Recent research suggests that personality is implicated in the aetiology of obesity, which could aid the development of more effective obesity interventions. Cross-sectional studies indicate that traits such as Neuroticism (N) and (Eysenckian) Psychoticism (P) are positively associated with body mass index (BMI), which is a widely used measure of body weight status (Brummett et al., 2006). In contrast, Conscientiousness (C) may be protective against obesity as it is inversely associated with BMI (Brummett et al., 2006). The findings for Extraversion (E) have been mixed; some studies report positive associations between E and BMI (Kakizaki et al., 2008), while others report no significant relationship (Brummett et al., 2006). Other personality traits such as novelty seeking and low self-directedness have also been linked with BMI (Sullivan, Cloninger, Przybeck, & Klein, 2007).

Importantly, longitudinal data are lacking in this area. Brummett et al. (2006) found that lower C predicted larger increases in BMI over a 14-year period. Terracciano et al. (2009) demonstrated that impulsiveness was positively correlated with 3-year weight gain in 4765 adults. These two studies provide some insight into the nature of the association between personality and weight change, but more longitudinal studies are required.

There is also a need to identify mechanisms linking personality traits with obesity and weight gain. One possibility is that personality influences body weight indirectly via lifestyle and behavioural factors. For example, Cs may be less likely to be obese and gain weight because they engage in health-enhancing behaviours such as regular physical activity (Goldberg and Strycker, 2002). Therefore certain health behaviours such as physical activity, alcohol consumption and diet may mediate the association between personality and obesity, but this has not yet been investigated.

The objective of this paper was to investigate the associations between personality, assessed in the context of the Five-Factor model of personality (Costa & McCrae, 1985), and obesity. This involved examining whether personality traits were associated with baseline obesity (cross-sectional analysis) and 2-year weight change (longitudinal analysis). We tested whether age and sex moderated these associations, consistent with previous studies. For example, Faith, Flint, Fairburn, Goodwin, and Allison (2001) found that E was negatively associated with BMI in females, but positively in males, and that N was linked with elevated BMI in females only. We also tested whether health behaviours (i.e. physical activity and alcohol consumption) mediated the associations between personality and obesity/weight gain.

## **2. Method**

### **2.1. Participants**

We utilised data collected through the Household, Income and Labour Dynamics in Australia (HILDA) survey, a household panel study that commenced in 2001 and involves follow-up collection every 12 months. The HILDA survey collects diverse information on demographic factors, health behaviours and personality variables through a face-to-face interview and self-completed questionnaire. The present study utilised data from three waves of the HILDA study (waves 5, 6 and 8) collected between 2005 and 2008, for 5265 adults aged 25–65 years (52.6% female). Approval to use the HILDA data for the purposes of the present paper was obtained from our university's Human Research Ethics Committee.

### **2.2. Measures**

In wave 5, participants completed a brief 36-item scale designed to assess the Five-Factor model of personality based on Goldberg's Big Five Markers Scale (Saucier, 1994). Velicer's Minimum Average Partial (O'Connor, 2000) test identified five distinct factors, which were

extracted using principle components analysis with direct oblimin rotation. Factor 1 comprised eight items reflecting emotional stability (e.g. moody, jealous) and was labelled N ( $\alpha = .82$ ). Factor 2 comprised seven items reflecting creativity and imagination and was labelled Openness to experience (O;  $\alpha = .74$ ). Factor 3 included seven items reflecting liveliness and was termed E ( $\alpha = .78$ ). Factor 4 comprised seven items reflecting organisation and discipline; it was termed C ( $\alpha = .80$ ). Factor 5 included five items that assessed a warm and kind nature and was labelled Agreeableness (A;  $\alpha = .78$ ). Two items ('enthusiastic' and 'traditional') had low factor loadings and/or cross loaded on several factors and were removed from the analyses.

In wave 6, participants reported their height and weight; BMI was subsequently calculated and coded as lean (BMI: 18.5–24.9), overweight (BMI: 25–29.9), and obese (BMI: 30–45). These categories were used as they provide information about health risk (World Health Organization, 2000). The percentage change in body weight between wave 6 and wave 8 was calculated and grouped into three categories: weight loss (i.e. >5% loss in body weight); stable body weight ( $\leq 5\%$  weight loss,  $\leq 5\%$  weight gain); and weight gain (i.e. >5% increase in body weight). These categories are consistent with previous studies and may indicate clinically significant weight change (Barzilay, Forsberg, Heckbert, Cushman, & Newman, 2006).

Information on other relevant variables was also collected and included in this paper. Where appropriate, we have re-coded data according to established health risk categories. Analysing the data for some variables in this way may be more meaningful than relying on continuous data which do not necessarily indicate health risk. Other variables such as age are treated as continuous variables.



Demographic characteristics (age, marital status, place of residence, employment status) assessed in wave 6 were included as covariates. Participants also completed the Short-Form Health Survey (SF-36), a 36-item questionnaire used to assess health and functioning across eight domains (Ware, Kosinski, & Gandek, 2000). We included scores on the general health and mental health domains as covariates in the analysis, consistent with previous research in the personality and health literature (Goodwin & Friedman, 2006).

Data on potential mediators (i.e. physical activity and alcohol consumption) were also included. Information on the number of bouts of moderate physical activity lasting 30 min or more was used to assess physical activity (coded as  $\leq 3$  times a week or  $>3$  times/week). We utilised these categories to provide an indication of whether or not participants engaged in sufficient levels of physical activity. Data on the frequency and amount of alcohol consumption were combined to form categories of alcohol consumption based on current Australian guidelines; this was to provide an indication of health risk associated with alcohol consumption (National Health & Medical Research Council, 2009). The three categories created were: (1) high-risk drinkers (consumed alcohol on  $\geq 3$  days, and usually consumed  $>2$  drinks on each occasion); (2) low-risk drinkers (consumed alcohol 1–2 days a week); (3) non-drinkers (abstainers or rarely consume alcohol). These variables were dummy coded (low-risk drinkers was the reference category) and included in the analyses.

### **2.3. Statistical analysis**

The first step in the analysis was to examine the correlations between each personality trait and BMI (analysed as a continuous measure). The correlations between BMI and the covariates and mediators were also examined. Binary logistic regression was then performed to examine the association between personality and BMI categories, with separate models for overweight and obesity (lean body weight was the reference category in both models). The

analyses involved three separate steps. First, the five personality variables were added as independent variables, with sex, age, marital status, area of residence, employment status and physical and mental health included as covariates. Second, personality-by-sex and personality-by-age (coded as  $\leq 45$  years and  $>45$  years) interaction terms were added to the model to test moderation. Third, the interaction terms were removed and physical activity and alcohol consumption were added as potential mediators. Attenuation of odds ratios between personality and weight status in the presence of physical activity and alcohol consumption could indicate mediation and would warrant further investigation.

The longitudinal analysis involved examining whether personality assessed at wave 5 predicted the change in body weight between wave 6 and wave 8. The data were also analysed using binary logistic regression modelling, with separate models for weight gain (versus stable weight) and weight loss (versus stable weight). The analyses involved the same three steps as the cross-sectional analysis, with the only difference being that baseline body weight status (coded as lean and overweight/obese) was also included as a covariate.

The data are presented as odds ratios (OR) and 95% confidence intervals, with significance determined by a  $p$  value of  $<.05$ . The only exception was for the personality-by-sex interactions where statistical significance was determined by a more conservative  $p$  value of  $<.001$ . In the interests of brevity, we do not present the results for the overweight versus lean comparison and the weight loss versus stable weight comparison in detail (e.g. these are omitted from Table 2).

### **3. Results**

#### **3.1. Preliminary analyses**

The demographic characteristics of the sample (including differences between males and females) are shown in Table 1. At baseline, 23.7% of participants were obese and this was slightly higher in males (24.3%) than females (23.2%). The stability of BMI was high ( $r = .847$ ), with 22.5% of the sample gaining >5% body weight over the 2-year period. Females were significantly more likely to have gained >5% body weight compared to males (26.1% versus 18.5%). There were some sex differences in regards to personality: females had higher E, C, and A scores, whereas males were higher on O and N. This latter finding is unexpected given that N is generally higher in females (Costa & McCrae, 1985), but the effect size was very small ( $\eta^2 = .005$ ) and may not be meaningful.

Table 1. Baseline characteristics of the sample.

	<b>Males (<i>n</i> = 2498)</b>	<b>Females (<i>n</i> = 2767)</b>	<b>Total (<i>n</i> = 5265)</b>	<b><i>P</i> value</b>
Age, M (SD)	45.38 (10.79)	44.77 (10.81)	45.06 (10.80)	.041
Baseline BMI, <i>n</i> (%)				
<i>Lean</i>	763 (30.5)	1327 (48.0)	2090 (39.7)	<.001
<i>Overweight</i>	1129 (45.2)	799 (28.9)	1928 (36.6)	
<i>Obese</i>	606 (24.3)	641 (23.2)	1247 (23.7)	
2 year weight change, <i>n</i> (%)				<.001
<i>Loss</i>	293 (11.7)	399 (14.4)	692 (13.1)	
<i>Stable</i>	1742 (69.7)	1647 (59.5)	3389 (64.4)	
<i>Gain</i>	463 (18.5)	721 (26.1)	1184 (22.5)	
Extraversion, M (SD)	30.54 (6.94)	32.77 (7.54)	31.71 (7.35)	<.001
Neuroticism, M (SD)	26.02 (8.41)	24.87 (8.31)	25.42 (8.38)	<.001
Openness, M (SD)	25.97 (6.05)	25.36 (6.29)	25.65 (6.18)	<.001
Conscientiousness, M (SD)	35.87 (6.56)	37.56 (6.71)	36.76 (6.69)	<.001
Agreeableness, M (SD)	26.26 (4.21)	28.62 (3.81)	27.50 (4.18)	<.001

#### Associations between personality and body weight status at baseline

N was positively correlated with BMI ( $r = .052, p < .001$ ), whereas O ( $r = -.039, p = .004$ ), A ( $r = -.045, p = .001$ ) and C ( $r = -.123, p < .001$ ) were inversely associated with BMI. BMI was also significantly associated with poorer General Health ( $r = -.210, p < .001$ ), lower physical activity ( $r = -.105, p < .001$ ) and increased age ( $r = .103, p < .001$ ); there were some other significant findings but the effect sizes (as indicated by  $\eta^2$ ) were small. The results of the regression models examining the associations between personality (assessed at wave 5) and obesity (assessed at wave 6) are shown in Table 2. The results demonstrate that N (OR = 1.08, 95% Confidence Interval [1.00–1.17]), E (OR = 1.13 [1.03–1.23]), and A (OR = 1.12 [1.02–1.23]) were positively associated with obesity. In contrast, C (OR = 0.80 [0.74–0.87]) was negatively associated with obesity. O (OR = 0.92 [0.86–0.99]) and C (OR = 0.89 [0.83–0.96]) were associated with reduced odds of being overweight. None of the interaction terms were significant, suggesting that neither age nor sex moderated the association between personality and body weight status. Adding physical activity and alcohol consumption to the models had little effect on the odds ratios (Table 2).

Table 2. Regression results examining the association between personality and obesity, and personality and 2-year weight change.

	Obese versus lean <sup>a</sup>		Weight gain versus stable weight <sup>b</sup>	
	OR	95% CI	OR	95% CI
<i>Model 1<sup>c</sup></i>				
Neuroticism	1.08*	1.00–1.17	1.00	0.92–1.09
Extraversion	1.13*	1.03–1.23	1.11*	1.03–1.19
Openness	0.93	0.86–1.00	1.02	0.95–1.10
Agreeableness	1.12*	1.02–1.23	0.99	0.91–1.07
Conscientiousness	0.80*	0.74–0.87	0.95	0.88–1.02
<i>Model 2<sup>d</sup></i>				
Neuroticism	1.13*	1.03–1.24	1.01	0.93–1.09

	Obese versus lean <sup>a</sup>		Weight gain versus stable weight <sup>b</sup>	
	OR	95% CI	OR	95% CI
Extraversion	1.11*	1.03–1.21	1.11*	1.03–1.20
Openness	0.94	0.87–1.01	1.03	0.96–1.10
Agreeableness	1.11*	1.01–1.21	0.99	0.91–1.08
Conscientiousness	0.82*	0.75–0.88	0.94	0.88–1.02

<sup>a</sup> O (OR = 0.92 [0.86–0.99]) and C (OR = 0.89 [0.83–0.96]) were associated with reduced odds of being overweight.

<sup>b</sup> None of the personality traits were significantly associated with weight loss.

<sup>c</sup> Model 1 includes age, sex, marital status, employment status, place of residence and general and mental health as covariates (2-year weight change model also included BMI).

<sup>d</sup> Model 2 includes all the variables in Model 1, with physical activity and alcohol consumption added as potential mediators.

\*  $p < .05$

### Associations between personality and 2-year weight gain

The results of the regression models examining the association between personality (assessed at wave 5) and 2-year weight gain (>5% weight gain between wave 6 and wave 8) are shown in Table 2. E was significantly associated with weight gain (OR = 1.11 [1.03–1.19]). None of the other personality traits were significantly associated with weight gain or with weight loss. There was also no evidence of significant personality-by-sex or personality-by-age interactions. Adding physical activity and alcohol consumption to the models (Model 2) had little effect on the odds ratios (Table 2), indicating that these variables did not mediate the association between personality and weight change.

## 4. Discussion

The present cross-sectional results indicated that C was associated with a reduced likelihood of baseline obesity, whereas A, N, and E were associated with an increased likelihood of obesity. These associations were independent of a range of health and demographic factors, and were not moderated by age or sex. These results add support to existing research examining the relationships between personality traits and obesity.

C was inversely associated with obesity, which is consistent with previous research (Brummett et al., 2006). Low C may contribute to obesity via health-impairing behaviours such as low physical activity and poor eating habits. The findings for N also support previous findings. N may contribute to obesity via mental health problems (e.g. anxiety and depression) (Roberts, Deleger, Strawbridge, & Kaplan, 2003), avoidance of physical activity, and/or poor eating habits.

Previous studies have produced mixed findings for the association between E and obesity. In our data, E was positively associated with obesity, which is interesting given that this trait reflects an active and social disposition. However, Es are also more likely to engage in health risk behaviours such as excessive alcohol consumption (Cook, Young, Taylor, & Bedford, 1998), which may be associated with higher levels of social activity. We found no evidence that alcohol consumption mediated the association between E and obesity, perhaps because the measure of alcohol did not specifically address level of consumption in social settings.

A was positively associated with obesity, which appears in conflict with previous studies (e.g. Brummett et al., 2006). These divergent findings likely reflect analytic differences in examining BMI as a continuous variable and BMI according to health risk categories. A may not contribute to obesity; instead, the observed association may reflect a trend for higher As to more accurately report their height and weight. Given that As are not known for their dishonesty (Costa & McCrae, 1985). This possibility requires further investigation.

The present study also investigated whether personality traits predict changes in body weight over a 2-year period. This is important given that only two previous studies have examined the longitudinal association between personality and obesity. Our longitudinal results indicate that E was associated with an increased likelihood of gaining >5% body weight (a clinically significant amount) over the 2-year period. As with the cross-sectional results, this finding was not moderated by age or sex. The mechanisms underlying the association between E and weight gain could be similar to those involved in the association between E and obesity discussed above. In particular, Es may be more likely to gain weight because of a greater tendency to engage in behaviours such as excessive alcohol consumption that promote weight gain; however, this was not supported in the mediation analysis.

#### **4.1. Conclusions and future directions**

The present study was limited by a reliance on self-reported data. We also found no evidence that physical activity and alcohol mediated the associations between personality traits and obesity/weight gain. This could be due to the relatively crude measures of these health behaviours, which may need to be addressed in future longitudinal studies. Strengths of the present study were the large sample size and the inclusion of potential confounding variables.

These results may have important treatment and prevention implications since tailoring interventions towards at-risk personality traits could improve the efficacy of obesity interventions that target lifestyle factors such as diet and exercise. For instance, it is known that high-N and low-C individuals are less receptive to health messages and hence less likely to engage in behaviours such as exercise. Thus, obesity interventions for these individuals would need to focus on promoting adherence to health behaviours such as exercise and diet. This could potentially be achieved by incorporating technologies such as SMS reminders (Sutin et al., 2010) in N or low-C individuals. Interventions for Es may need to focus on

reducing unhealthy behaviours in social settings (e.g. alcohol consumption) that promote weight gain. Developing personality specific interventions may not prove to be easy, but as the obesity epidemic continues to grow along with adverse health, social and economic consequences, tailoring interventions towards personality traits could be an effective strategy.



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